COMPENSATION

FOR THE

UNEXHAUSTED MANURIAL VALUES

OF

FEEDING STUFFS AND FERTILISERS.

BY

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AND

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REMOTE STORAGE

COMPENSATION FOR THE UNEXHAUSTED MANURIAL VALUES OF FEEDING STUFFS AND FERTILISERS.

THE first attempt at putting on a really scientific basis the compensation to be awarded for the unexhausted manurial values of foods consumed on the farm was made by Lawes and Gilbert as long ago as 1870.

After showing the fallacy of assessing compensation on the basis of the original "cost" of the materials, Lawes and Gilbert drew up a table of values founded upon the actual manurial constituents left in the dung after deducting what had been lost in the maintenance and live-weight increase of the animal, and also any loss incurred during making and storing of the manure.

The Tables thus drawn up were first published in 1875. They were subsequently revised in the years 1885, 1897, and 1898.

Changes in the prices of manurial constituents, and increase of knowledge as the result of experience derived from experimental work, conducted alike at Rothamsted, Woburn, and on the Continent, with regard to the losses in the making of farmyard manure and the practical value of the manurial constituents of food in a rotation, led to a reconsideration of the scale. This was done by the present writers in 1902.

The Tables, thus revised, met with general acceptance, and in large measure have replaced the local systems formerly in vogue.

Time, however, has brought its changes again, and there has been a growing feeling that still further revision is required. Firstly, the prices of manurial ingredients have gone up, more especially in respect of the nitrogenous ones. Further, the inconvenience of spreading compensation over so long a period as four years has been increasingly felt. These circumstances induced the leading professional bodies connected with agricultural valuation to meet in conference, and ultimately the present writers were invited to again undertake a revision of the Tables, and to give replies to a number of questions which were raised in the progress of the discussion. We were further invited to deal, not only with foods consumed on the farm, but also to draw up, if possible, a scale of compensation for artificial and other manures used on the farm, but the full value of which had not been worked out by crop-growing.

Our replies to these various questions are contained in the report recently issued (October, 1913) to the Central Association of Agricultural and Tenant Right Valuers.

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It has been thought desirable, in addition to putting forward our revised Tables and our replies to the enquiries made, to contribute a paper in which there would be set out the general considerations which have weighed with us in giving our recommendations.

By the kind consent of the Central Association, permission has been accorded us to publish this in the Journal of the R.A.S.E., where our former Tables of 1902 appeared.

REASONS FOR REVISION OF PREVIOUS TABLES.

We propose considering first the circumstances which have led to a revision of the earlier Tables. These reasons are twofold—(1) The rise in prices of manurial ingredients ; (2) the growing feeling that the spreading of compensation over a period of four years is alike inconvenient and not borne out by recent investigation nor in actual agricultural practice.

RISE IN PRICES OF MANURIAL INGREDIENTS.

It may at once be pointed out that fertilisers generally have decidedly gone up in price since 1902. This applies mainly to nitrogenous fertilisers, potassic ones having remained much about the same, while phosphatic fertilisers have increased slightly, though, perhaps, hardly materially. The rise in unit value of nitrogen, however, has been very marked. Sulphate of ammonia, for example, has risen in price, since 1902, from 12*l.* a ton to about 14*l.* ; nitrate of soda, similarly, from about 10*l.* a ton to 12*l.*, and other nitrogenous materials in proportion.

In our former Tables we put the unit value of nitrogen, as found in common nitrogenous manures used on the farm (such as sulphate of ammonia, nitrate of soda, bone meal, fish manure, blood, shoddy, guano, &c.), at 12*s.* per unit. A revision of current prices for the above materials warrants us in now putting the unit value of nitrogen at 15*s.* instead of 12*s.* as formerly.

We do not consider it necessary to make any alteration as regards phosphoric acid. There has been a slight rise in the price of phosphatic manures, but not a material one. Superphosphate, basic slag, and bone dust, for instance, have remained much as they were. This is also the case with fertilisers supplying mainly potash ; Kainit, for instance, has remained steadily at about 50*s.* per ton.

The question was, of course, present in our minds, whether the change in prices was merely a fluctuation, or a permanent change. We have come to the conclusion that the rise is likely to be sustained for some time to come, and is not merely temporary, and we have felt that we should alter our Tables in this direction accordingly.

COMPENSATION FOR LOSS OF POTASH.

We have, however, considered it desirable to introduce a change of another kind in our Tables as regards the compensation to be given for potash. Previously we had reckoned the whole of the potash to be recovered in the manure. This, however, we now think to be hardly correct, and that, as with phosphoric acid, so with the potash, there must be a certain loss of potash, more especially in respect of the loss by drainage of the liquid portions of manure. Accordingly, we have, in our new Tables, suggested that three-quarters of the potash, and not the full amount, be credited to the manure.

PERIOD OVER WHICH COMPENSATION SHOULD BE SPREAD.

In 1902 we proposed that compensation should be spread over a period of four years. This was based on the fact that, taking a rotation course, as exemplified in the Rothamsted and Woburn Experiments, there was evidence of the influence of manurial application lasting up to the fourth crop of a rotation. Indeed, it could be shown by the Woburn Experiments on the continuous growth of wheat and barley, that the applications of farmyard manure made from purchased foods continued to show a residue from their application for a much longer period than this. Some influence could even be shown for so long a time as twenty years, the land being practically raised permanently in fertility, for the crops grown subsequently never went down to the level of the unmanured plots.

On the other hand, we have had to take into account more particularly the fact that the nitrogen contained in purchased feeding stuffs (and it is chiefly nitrogren for which compensation is paid) is, in the main, contained in digestible compounds, and is therefore excreted from the animal as urea. This urea passes rapidly into ammonia, which is not only subject to loss in the manure, but also exerts its effect on the first and second crops only that are grown with the manure. The experiments at Rothamsted, to be described later, show practically no returns in the third and later crops for the increased nitrogen in the dung that is brought about by cake feeding, &c. The long continued effect of dung is due to the more slowly acting compounds of nitrogen contributed by the litter and the undigested residues of the food.

In our former paper (1902) we gave instances from rotation experiments conducted both at Rothamsted and at Woburn, the general outcome of which was to show that when a root-crop was fed on the land, and was followed by barley, the barley crop was materially benefited thereby; that the next crop showed also a gain, but a much reduced one, and that when the wheat crop—the fourth in the rotation—was reached, the influence of the manuring had practically ceased to tell. These experiments are fully discussed in the R.A.S.E. Journal, Vol. 63, 1902, pp. 99-105, and as the continuation of them from then to the present date gives results similar to the foregoing, we consider that we are justified in reducing the period over which compensation shall be spread.

Taking all these matters into consideration, we are now agreed that in practice a period of four years over which compensation is to be spread, is inconveniently long and hardly borne out by experience. Moreover, the farmer's records rarely extend so far back as four years, nor can they be adequately checked.

The desire is evident to have matters of compensation promptly settled as between the in-coming and the out-going tenant. Accordingly, we are agreed to recommend that a period of two years be substituted for our previous one of four years over which compensation is to be spread, and we have revised our Tables in this sense.

MANURE MADE UNDER DIFFERENT CONDITIONS.

We have introduced a further change in our Tables, feeling, as we do, that a discrimination should be drawn between manure that is made in yards and that obtained by feeding direct on the land. It is recognised that when an animal is being fed upon the land, the urine, which contains the most valuable manurial constituents of the food, is very completely absorbed by the soil, without the large loss of ammonia that occurs during the making and storage of dung.

In the case of manure stored in heaps it is on the nitrogen that the loss chiefly falls, both through the storage of the manure and the washing by rain and loss by drainage which it may suffer.

It would only seem right, therefore, that higher compensation should be given for the food that is fed direct on the land than for that which is consumed in yards and the manure subsequently stored in heaps.

In our original Tables, as the result of experiments on the losses which farmyard manure undergoes in making and storing, we reckoned that 50 per cent. of the total manurial constituents would be lost under ordinary good farming practice before the manure went out on the field.

We now consider that when the manure is not subject to these changes it would be right to allow for 70 per cent. of the nitrogen being retained instead of the 50 per cent. given in our former Tables. This should apply equally to the case of sheep feeding on the land and to bullocks and cows on pasture when either class of stock is consuming cake or corn, the manure being deposited direct on the land.

As this increase is due to the greater proportion of ammonia saved, it should only apply to the crop for which the manure is directly used, and not for a subsequent crop. Accordingly, we have divided the column D into two sections according as the food is consumed in yards, D (1) and D (2), or is fed direct on the land, D (3) and D (4).

In suggesting this change we are aware that we are complicating our Tables by the introduction of additional columns, and that it would be more convenient to have a single scale which would meet all purposes.

We are, however, so convinced of the justification for drawing a distinction between food consumed on the land and that made into manure in the yard, that, at the risk of complication, we have introduced this modification.

It may be said that it is impossible to get to know how much cake, &c., is fed on the land, and how much at home, and that a farmer about to quit will be disposed to claim for a large proportion having been fed on the land, so that he may get compensation on the higher scale. But we do not anticipate more difficulty over this than there is in ascertaining, as at present, whether the cake has been purchased at all, and how much. In any case the valuer will know the custom of the country, and whether it is usual to feed one-half, one-third, or some other proportion of the roots on the land, and, similarly, how the grass land is treated in this respect. With this knowledge, the existence of the supplementary columns, D (3) and D (4), will enable the valuer to reckon what proportion he may fairly put to one head or the other.

"FIRST YEAR"—"SECOND YEAR."

Some misunderstanding having arisen from the use of the expressions "First year," "Second year," &c., in our former Tables, we have thought it well to indicate clearly in our revised ones what we mean by this.

By "First year" we mean the year in which the manure is made, whether it be in yards and stored for later use, or whether it has been already put on the land as in the case of sheep feeding or in that of bullocks consuming cake or corn on pasture, but in all cases before the crop, if any, grown with the manure has been utilised. The first column, D (1), of our new Table means the value to be assigned to the manure before the out-going tenant has derived any benefit from it.

By "Second year" we wish to indicate the state of things that rules after a crop has been grown with the manure, that is, the residue still remaining after that crop has been grown.

To make this clear, we have substituted for "First year," "Second year," &c., in our Tables the terms "Before one crop has been grown," "After one crop has been grown." As a rule the manure will have been made during the winter and be applied to the following spring or root crop. D (1) will accordingly, as a rule, mark the value of the manure as it is in the yards, D (2) after the root crop has been grown.

In a case where the manure has been used for the root crop, and where this crop, though still on the land at the time of the giving up of the tenancy, has to be paid for by the in-coming tenant, the value is indicated by column D (2), for the manure has been used for the crop, and is clearly not of the same value as when lying in the yards, but is only the residue left after the taking out by the root crop of what the latter will utilise.

STORING OF MANURE.

Another point upon which there has been misunderstanding is in regard to the conditions under which we presume the manure to have been made at the time it is valued, and the precautions against loss that should have been observed in the making and storing of it. We would state clearly that our Tables, as set out, presume the manure to have been made in boxes or yards where there is no avoidable loss by drainage, and where the manure is not washed by rain; further, that the manure has been made with all reasonable care, and that it has been stored, protected from the rain, and not unduly exposed or otherwise subjected to loss.

We have shown in our original Tables that even under ideal conditions, such as those which existed at Woburn (where the manure was made in pits with cemented bottom and sides, and was, after removal. covered with earth) there was an unavoidable loss of from 30 to 35 per cent. of the original manure value as calculated from the composition of the materials used. Reckoning that these conditions would not be obtained in ordinary practice, we followed Lawes and Gilbert in their estimate that the loss would be about 50 per cent. under ordinary good farming conditions, and our Tables are based on this assumption. When these conditions have not been complied with, and the manure has been made in open yards and has been exposed to rain, so that the liquid portions may to a great extent have drained away, or where the manure has been left exposed in uncovered heaps in a field and the washings have sunk into the earth around, it is clear that the losses may be still more.

It is impossible to frame separate scales for all such sets of conditions, and this is a matter on which the valuer must exercise his discretion, and make such deductions as, in his opinion, are justified. But, seeing that manure, be it ever so badly kept, can only to a limited extent be deprived of its manurial constituents, and that the more insoluble portions will remain in the dung despite much washing by rain, we have felt it wise to insert the provision that any deduction on account of bad storage shall not exceed 50 per cent. of the value as set out in our column D (1); that is, even in the worst cases a figure not lower than one-half the corresponding one in our Table D (1) will represent the value of the manure.

NEW FEEDING MATERIALS.

We have been frequently asked if we would be willing to extend our Table of Foods by the inclusion of further items, new feeding materials, &c. While this is undoubtedly desirable in the case of foods in regular use, we feel it necessary to avoid overloading our Tables with matter that would only be of occasional use.

For the same reason we think it desirable to exclude all articles which are really of a "proprietary" character, and others which come on the market for a time and then disappear. Moreover, the Fertilisers and Feeding Stuffs Act now obliges vendors to give on the invoice the analysis of the foods which they sell. Included in such statements are the albuminoids, and from these the nitrogen—which is the main manurial constituent—can be obtained by dividing the percentage of albuminoids by 6¼. The phosphoric acid and potash are of minor significance, and will not vary in foods to the extent that the albuminoids do. It is accordingly comparatively simple in the case of a material not included in our Tables, but with the analysis in hand, to assign to it, by comparison with foods of like composition, its appropriate place in the Table and its manurial value.

Our opinion has been asked if we would include such things as gluten meal, meat meal, compound cakes, and "proprietary" articles such as "uveco," "molassine meal," &c., also treacle.

The use of some of these does not seem to us sufficiently general to warrant their inclusion, while others, such as "molassine meal" and treacle, have no appreciable manurial value at all. At the same time we have thought it well to add to our list three further materials. These are soya bean cake, earth-nut cake, and Bombay cotton cake. The widespread use of the latter makes it desirable to separate it from the ordinary or "Egyptian" cotton cake, and this we have accordingly done.

MECHANICAL VALUE ATTACHING TO STRAW USED AS MANURE.

It is recognised that, in addition to the manurial constituents of value which straw manure possesses, it exercises a further benefit, one which can best be described as its "mechanical" value. This benefit is exercised alike on light and on heavy soils when farmyard manure made with straw is used. To the former class of soil it imparts "substance" and tends to retain moisture in the land; on heavy soils it helps to open them out, lightens them, and renders drainage easier. These beneficial effects are over and above anything possessed by the purely manurial ingredients of the dung; accordingly, when straw has been sold off the farm that ought to have been used as litter, we consider that the farm has been depreciated to this extent, and that additional compensation should be paid when the land has been so deprived of these benefits.

This would not apply, however, where the hay or straw would normally have been given as food to stock. Moreover, it must be left to the valuer to determine what proportions should, under the ruling custom of the district, have been consumed, and what proportion trampled down as litter by stock. Also, it may be that there are cases where it can be clearly shown that land would not be benefited by such application, and is not in need of the mechanical benefits conferred by the use of straw dung. This, again, is a matter which must be left to the discretion of the valuer.

The mechanical value of the straw thus used we consider to be about equal to that of its manurial benefit, and we consequently assign a figure of 7*s.* per ton to be paid as compensation for removal of straw, in addition to the 7*s.* per ton already allowed for its manurial value.

We should point out that, in dealing with this matter, we have had purely to do with the losses of manurial material to the land, and not with any point that has reference to breach of custom, contract, or agreement.

FOOD-STUFFS FED TO MILKING COWS.

The question has been asked whether in the case of foods given to milking cows less compensation should be allowed than for the same foods when given to fattening beasts, because of the constituents taken off the farm in the form of milk, or by the fact of the cows carrying their calves.

It is quite true that milking cows excrete less of the nitrogen, phosphoric acid, &c., in their food than do fattening bullocks. They are, however, pastured to a greater degree upon the land, under which conditions they will return more than do bullocks which are fed in the yard; hence in this case the value of their excreta would probably be represented by figures somewhat in excess of those of column D (1).

On the other hand, while the cows are within doors the proper amount of compensation would be less than that indicated in D (1). The circumstances of the case could only be met by the addition of another column to the Tables, or, more probably, two fresh ones. Apart from the inconvenience of this, there would have to be taken into consideration what proportion of the time the cows were out at grass, and what time under cover. This would be very hard to arrive at, and so we have decided that it would be better to class these cases all together, and apply the figures of column D generally to foods consumed by milking cows as well as by fattening bullocks. It would be open to the valuer to use his discretion either as to allowing rather more when the cows were, for the greater part of the year, out at grass, or a somewhat less amount where the cows were kept in the stalls with little or no litter, and where the urine to a large extent went to waste.

FOOD-STUFFS FED TO YOUNG STOCK.

It might similarly be urged that young stock, by reason of their building up their body structure, will use up more of the constituents of food and return less in manure than would older stock, and that, therefore, a less value should be assigned in their case to the litter. But in practice it is never possible to discriminate between what food is given to young stock and what to older, nor would the manure of each be kept separate. Nor again would it, more than exceptionally, be the case that only young stock was kept on a farm. So here, too, we think it advisable to avoid bringing any further sub-divisions into our Table, and to class the manure from young and old stock alike under D.

FOOD-STUFFS FED TO PIGS.

Much the same question has been raised in regard to the manure made by pigs. It would, however, seldom be the case that the manure from pigs was kept separate from the rest, and, on a general farm, all manure, whether from fattening bullocks, milking cows, young stock, or pigs, would be put together in one heap, and be used indiscriminately.

It would overburden the Tables to no good purpose to attempt to provide for all these varied circumstances, and, accordingly, we have decided to class them together.

FERTILISERS.

In addition to revising our scales for compensation to be paid for Feeding-stuffs consumed, we were asked to put out, if

TABLE I.—*Showing the Composition, Manurial and Lawes and Gilbert's Tables*, 1897,

No.	Foods	VALUATION PER TON AS									
		A Nitrogen					B Phosphoric acid				
		Per cent. in food	Value at 15*s.* per unit		Half of value to manure		Per cent. in food	Value at 3*s.* per unit		Three-quarters of value to manure	
		Per cent.	*s.*	*d.*	*s.*	*d.*	Per cent.	*s.*	*d.*	*s.*	*d.*
1	Decorticated cotton cake	6·90	103	6	51	9	3·10	9	4	7	0
2	Undecorticated cotton cake (Egyptian)	3·54	53	2	26	7	2·00	6	0	4	6
3	Undecorticated cotton cake (Bombay)	3·10	46	6	23	3	2·50	7	6	5	7
4	Linseed cake	4·75	71	4	35	8	2·00	6	0	4	6
5	Linseed	3·60	54	0	27	0	1·54	4	7	3	5
6	Soya-bean cake	6·85	102	8	51	4	1·30	3	11	2	11
7	Palm-nut cake	2·50	37	6	18	9	1·20	3	7	2	8
8	Cocoa-nut cake	3·40	51	0	25	6	1·40	4	2	3	1
9	Earth-nut cake	7·62	114	4	57	2	2·00	6	0	4	6
10	Rape cake	4·90	73	6	36	9	2·50	7	6	5	8
11	Beans	4·00	60	0	30	0	1·10	3	4	2	6
12	Peas	3·60	54	0	27	0	0·85	2	7	1	11
13	Wheat	1·80	26	10	13	5	0·85	2	7	2	0
14	Barley	1·65	24	10	12	5	0·75	2	3	1	8
15	Oats	2·00	30	0	15	0	0·60	1	10	1	5
16	Maize	1·70	25	6	12	9	0·60	1	9	1	4
17	Rice meal	1·90	28	8	14	4	0·60	1	9	1	4
18	Locust beans	1·20	18	0	9	0	0·80	2	5	1	10
19	Malt	1·82	27	4	13	8	0·80	2	5	1	10
20	Malt culms	3·90	58	6	29	3	2·00	6	0	4	6
21	Bran	2·50	37	6	18	9	3·60	10	10	8	2
22	Brewers' grains (dried)	3·30	49	4	24	8	1·61	4	10	3	8
23	Brewers' grains (wet)	0·81	12	4	6	2	0·42	1	3	0	11
24	Clover hay	2·40	36	0	18	0	0·57	1	9	1	4
25	Meadow hay	1·50	22	6	11	3	0·40	1	2	0	11
26	Wheat straw	0·45	6	8	3	4	0·24	0	9	0	7
27	Barley straw	0·40	6	0	3	0	0·18	0	6	0	4
28	Oat straw	0·50	7	6	3	9	0·24	0	9	0	7
29	Mangolds	0·22	3	4	1	8	0·07	0	3	0	2
30	Swedes	0·25	3	10	1	11	0·06	0	2	0	1
31	Turnips	0·18	2	8	1	4	0·05	0	2	0	1

Compensation Values of Feeding Stuffs (*Revised from and Voelcker and Hall's Tables*, 1902).

Manure					Compensation value for each ton of the food consumed								Foods	No.
C Potash					**D**									
					Food made into dung				Food consumed on land					
					(1)		(2)		(3)		(4)			
Per cent. in food	Value at 4s. per unit		Three-quarters of value to manure		Before one crop has been grown or removed		After one crop has been grown or removed		Before one crop has been grown or removed		After one crop has been grown or removed			
Per cent.	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*		
2·00	8	0	6	0	64	9	32	4	85	6	32	4	Decorticated cotton cake	1
2·00	8	0	6	0	37	1	18	6	47	9	18	6	Undecorticated cotton cake (Egyptian)	2
1·61	6	5	4	10	33	8	16	10	43	0	16	10	Undecorticated cotton cake (Bombay)	3
1·40	5	7	4	2	44	4	22	2	58	10	22	2	Linseed cake	4
1·37	5	6	4	2	34	7	17	3	45	4	17	3	Linseed	5
2·20	8	10	6	7	60	10	30	5	81	6	30	5	Soya-bean cake	6
0·50	2	0	1	6	22	11	11	5	30	6	11	5	Palm-nut cake	7
2·00	8	0	6	0	34	7	17	3	44	9	17	3	Cocoa-nut cake	8
1·50	6	0	4	6	66	2	33	1	89	1	33	1	Earth-nut cake	9
1·50	6	0	4	6	46	11	23	5	61	8	23	5	Rape cake	10
1·30	5	2	3	10	36	4	18	2	48	4	18	2	Beans	11
0·96	3	10	2	10	31	9	15	10	42	6	15	10	Peas	12
0·53	2	1	1	7	17	0	8	6	22	5	8	6	Wheat	13
0·55	2	2	1	7	15	8	7	10	20	8	7	10	Barley	14
0·50	2	0	1	6	17	11	9	0	23	11	9	0	Oats	15
0·37	1	6	1	1	15	2	7	7	20	4	7	7	Maize	16
0·37	1	6	1	1	16	9	8	4	22	6	8	4	Rice meal	17
0·80	3	2	2	4	13	2	6	7	16	9	6	7	Locust beans	18
0·60	2	5	1	10	17	4	8	8	22	9	8	8	Malt	19
2·00	8	0	6	0	39	9	19	10	51	6	19	10	Malt culms	20
1·45	5	9	4	4	31	3	15	7	38	10	15	7	Bran	21
0·20	0	10	0	8	29	0	14	6	38	11	14	6	Brewers' grains (dried)	22
0·05	0	2	0	1	7	2	3	7	9	9	3	7	Brewers' grains (wet)	23
1·50	6	0	4	6	23	10	11	11	31	0	11	11	Clover hay	24
1·60	6	5	4	8	16	10	8	5	21	4	8	5	Meadow hay	25
0·80	3	2	2	4	6	3	3	1	7	7	3	1	Wheat Straw	26
1·00	4	0	3	0	6	4	3	2	7	6	3	2	Barley Straw	27
1·00	4	0	3	0	7	4	3	8	8	11	3	8	Oat Straw	28
0·40	1	7	1	2	3	0	1	6	3	8	1	6	Mangolds	29
0·22	0	11	0	8	2	8	1	4	3	7	1	4	Swedes	30
0·30	1	2	0	11	2	4	1	2	2	10	1	2	Turnips	31

possible, a similar scale for the assessment of the unexhausted value of such Fertilisers as are generally used on a farm, and to indicate what might be expected to be the period of duration of these, and how much of the original value is left after the taking of one or more crops. This we have found to be by no means an easy matter. In the first place, reliable sources of information are but few in number. Then, it is well-known that different fertilisers act very differently according to the nature of the land to which they are applied. Thirdly, there are the differences attaching to the growing of different crops, for these will not all alike remove the same constituents, nor to the same extent. The influence of manures must depend, not only upon the suitability of them for the particular purpose for which they are employed, but also upon the condition of the land, and whether they have been rightly applied. Hence, to draw up a set of Tables attempting to provide for all cases that might occur, for all classes of land, for all variations of cropping and rotation, would involve such complication as to render them practically useless.

The most we have been able to do is, after a consideration of such data as exist, and of what is known generally regarding the action of different fertilisers, to draw up a general Table which, at least, will have the merit of being an approximation to the truth, and certainly be better than many of the haphazard and variable systems of valuation at present adopted.

We have, however, seen it well to discriminate between the application of fertilisers to arable land and grass land respectively. Where, as in the latter case, there is always a crop on the land, the constituents of manure are more fully retained and do not drain away so readily as on arable land.

Thus, we have allowed, in the case of grass land, compensation to extend over a longer period than with arable land. Notably is this the case with such materials as basic slag and lime, the influence of which is known practically to last longer on grass land.

Though one crop, say for example, a cereal crop, will not take as much out of the land as does a root crop or a potato crop, it is impossible to discriminate between the residues each would leave behind. The decisive factor is less the withdrawal by the crop than the changes which afterwards go on in the soil.

Between different classes of soil, also, we have not been able to discriminate, but must leave it to the discretion of the valuer whether the manures have been rightly applied or not. This is more especially the case when manure has been put on grass land, *e.g.* in cases such as those of superphosphate, bones, basic slag, and lime. Superphosphate, for example, is in some parts advantageously used for grass land ; in other parts no benefit is experienced from it. Basic slag, again, is invaluable on some lands, but useless on others. Bones, in their different forms, are very variable as regards their results ; while lime, though indispensable on some soils, may not be called for at all on others.

The matter of the prices charged for manures is again one beyond our power to check ; we must assume these to be fair. Inasmuch, however, as the Fertilisers and Feeding Stuffs Act compels the giving of the analysis on the invoice, a safeguard is introduced by which a competent valuer can form some opinion, or upon which expert opinion can be taken, as to the reasonableness of the price charged. We must, therefore, leave it to be understood that, while the Tables we have set out are to be taken as a guide, they must be subject to such modifications as the particular circumstances of the case demand.

The most recent information as to the residual value of fertilisers is that obtained from a large series of experiments which were commenced in 1904 in Little Hoos Field, Rothamsted, and which are still in progress. These have already given certain definite issues regarding the residue left for subsequent crops after one or more have been taken off the land.

Perhaps one of the most striking points brought out is that phosphates, whether derived from superphosphate, bones, or basic slag, behave much alike as regards their residues. A further point is that in nitrogenous manures like Peruvian guano, fish guano, meat meal, &c., as also in manure cakes, the greater portion of the value is used up in the first crop. Slowly-acting organic manures, such as shoddy, hoofs, and horns, &c., last for a longer period, and for this duration allowance should be made.

As regards lime, the Woburn Experiments have clearly shown the duration of this both on arable and on grass land. Lastly, the Rothamsted and Woburn Experiments alike have demonstrated that for such soluble salts as nitrate of soda, sulphate of ammonia, and the like, there is practically nothing left over after the first crop has been taken off.

Acting on these data, we have drawn up the following Table of compensation (page 14) for the use of fertilisers generally.

The first point that will probably strike the practical man as being somewhat strange is the putting of superphosphate and bones on the same level. This, however, is the direct outcome of the experiments on Little Hoos Field, and superphosphate must clearly not be considered the transient material which it is too often supposed to be. On grass land, bones may be

Table II.

Table showing the Compensation to be awarded for the use of Fertilisers.

	ON ARABLE LAND					ON GRASS LAND						
	After 1st crop	After 2nd	After 3rd	After 4th	After 5th	After 1st year	After 2nd	After 3rd	After 4th	After 5th	After 6th	After 7th
*Superphosphate . .	$\frac{2}{3}$ of cost	$\frac{1}{3}$	$\frac{1}{9}$	—	—	$\frac{2}{3}$ of cost	$\frac{1}{3}$	$\frac{1}{9}$	—	—	—	—
*Bones (raw and steamed)	$\frac{2}{3}$	$\frac{1}{3}$	$\frac{1}{9}$	—	—	$\frac{2}{3}$	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—
Dissolved Bones . .	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{12}$	—	—	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{12}$	—	—	—	—
*Basic Slag . . .	$\frac{2}{3}$	$\frac{1}{3}$	$\frac{1}{6}$	—	—	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{8}$
Bone Manures . .	$\frac{2}{5}$	$\frac{1}{5}$	—	—	—	$\frac{2}{5}$	$\frac{1}{5}$	—	—	—	—	—
Compound Manures not containing Bone .	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—	—	—
Peruvian Guano . .	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—	—	—
Fish Guano . . .	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—	—	—
Meat Meal . . .	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—	—	—
Shoddy and Wool Waste, Fur Waste, Hair, Hoofs and Horns, Greaves, &c. . .	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	—	—	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	—	—	—	—
Manure Cakes . .	$\frac{1}{5}$	$\frac{1}{10}$	—	—	—	$\frac{1}{5}$	$\frac{1}{10}$	—	—	—	—	—
Dried Blood, Sulphate of Ammonia, Nitrate of Soda, Nitrate of Lime, Cyanamide .	Nothing					Nothing.						
Kainit and Potash Salts.	$\frac{1}{2}$	$\frac{1}{4}$	—	—	—	$\frac{1}{2}$	$\frac{1}{4}$	—	—	—	—	—
Lime	$\frac{5}{6}$	$\frac{2}{3}$	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{6}$	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{8}$

* The Valuer must exercise his discretion as to the suitability of these manures when used upon grass land.

expected to yield a benefit for a longer period, and we have lengthened their duration accordingly. Dissolved bones are more rapid in their action, and so a higher proportion has been put down as being taken up by the first crop. Regarding basic slag, a long series of statistics exist, notably those from the Cockle Park Farm of the Northumberland County Council. While basic slag is not so certain in its action on arable land, it is clear that, where it is well suited to grass land, the benefit may last for seven to eight years.

Bone and compound manures are very variable in composition, and it is with these that one meets with most cases of comparatively high prices being charged; we think ourselves justified, therefore, in putting these into a lower scale as regards their residual value than superphosphate or dissolved bones.

It may again cause some surprise that the effect of nitrogenous manures such as Peruvian guano, fish guano, and meat meal, is reckoned to be so readily exhausted; but this is what the experience of the Rothamsted Experiments in Little Hoos Field has shown. The same applies even more strikingly to manure-cakes and dried blood. It will, however, create no surprise to those who have followed the Rothamsted and Woburn Experiments, that we allow no appreciable residue in the case of nitrate of soda, sulphate of ammonia, or the more recently introduced nitrogenous fertilisers, cyanamide, nitrate of lime, &c.

Potash salts, however, possess a longer duration in the soil, and hence we reckon them to last through to the third crop.

Lastly, as regards lime, we have clear evidence from the Woburn Experiments that, on arable land, lime, when required, will exercise tangible benefit for quite seven years, and, on grass land, may be expected to last even longer.

In drawing up these new Tables, we have been actuated solely by the desire to put the system of valuation of unexhausted residues on as scientific a basis as possible, while having due regard to practical considerations. We know well the imperfections of our own knowledge of the subject, but, so far as the results of actual experiment are available, we have endeavoured to utilise these for the purpose of drawing up our Tables. We in no way, however, wish it thought that we are proposing to dispense with the Valuer, for, as our Paper will have shown, there are numerous points in which the judgment of the Valuer must be exercised, and our Tables are intended primarily to give him a sound basis upon which to work.

We have been much gratified by the reception already given to our earlier Tables, and we can but hope that the present revision and extension of them will be found of real benefit and will meet with general acceptance.

J. AUGUSTUS VOELCKER,
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